

U.S. Patent Application Serial No. 10/511,442
Response filed July 6, 2006
Reply to OA dated March 6, 2006

AMENDMENTS TO THE CLAIMS:

Claims 1,3,5,6,8,10-13,15-17 and 19-21 are pending in the application.

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (Currently Amended): A process for producing a synthetic resin foam comprising the step of reacting at least one polyol with at least one polyisocyanate compound in the presence of an organic blowing agent and a catalyst,

the blowing agent being a mixture comprising 1,1,1,3,3-pentafluorobutane (HFC-365mfc) and at least one ~~low-boiling~~ halogen-containing compound,

wherein the organic blowing agent and the polyol mixture forms a premix which is substantially nonflammable;

wherein the at least one ~~low-boiling~~ halogen-containing compound is nonflammable and has a relatively low thermal conductivity and a boiling point of about -90 to about ~~[[10]]~~ 60°C ~~[[and]]~~,

the thermal conductivity of the halogen-containing compounds in the gaseous state is about 8 to about 30 mW/mK at about 1 atmospheric pressure, and

the halogen-containing compound is at least one member selected from the group consisting of 1,2,2-trifluoroethylene trifluoromethyl ether (CF₂=CFOCF₃), 1,2,2-trifluoroethylene 1,1,2,2,3,3,3-heptafluoropropyl ether (CF₂=CFOCF₂CF₂CF₃), perfluoropropyl epoxide

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(CF₃CF(O)CF₂), perfluoro-1-butene (CF₂=CFCF₂CF₃), perfluorohexenes (C₆F₁₂), perfluorononenes (C₉F₁₈), perfluorohexane (C₆F₁₄), perfluorocyclobutane (c-C₄F₈), iodotrifluoromethyl (CF₃I), 1,1,1,2,3,3-hexafluoropropane (CF₃CFHCF₂H), 1,1,1,3,3,3-hexafluoropropane (CF₃CH₂CF₃), 1,1,1,2,3,3,3-heptafluoropropane (CF₃CFHCF₃), pentafluoroethane (CF₃CF₂H), tetrafluoroethanes (CHF₂CHF₂, CF₃CFH₂), trifluoromethane (CF₃H), 1,1,2,2,3,3,4,4-octafluorobutane (CF₂HCF₂CF₂CF₂H), 1,1,1,2,2,3,4,5,5,5-decafluoropentane (CF₃CF₂CFHCFHCF₃), 2-trifluoromethyl-1,1,1,2,3,4,5,5,5-nonafluoropentane (C₆F₁₂H₂), 3,3,4,4,5,5,6,6,6-nonafluoro-1-hexene (F(CF₂)₄CH=CH₂), 2,3,3,4,4,5,5-heptafluoro-1-pentene (CH₂CFCF₂CF₂CF₂H), trifluoroethylene (CF₂CFH), 1,1,2,2-tetrafluoroethyl difluoromethyl ether (CF₂HCF₂OCHF₂), 1,1,2,2-tetrafluoroethyl methyl ether (CF₂HCF₂OCH₃), 2,2,2-trifluoroethyl 1,1,2,2-tetrafluoroethyl ether (CF₃CH₂OCF₂CF₂H), 1,1,2,3,3,3-pentafluoropropyl methyl ether (CF₃CFHCF₂OCH₃), nonafluorobutyl methyl ether (C₄F₉OCH₃), 1-trifluoromethyl-1,2,2,2-tetrafluoroethyl methyl ether ((CF₃)₂CFOCH₃), perfluoropropyl methyl ether (CF₃CF₂CF₂OCH₃), 2,2,3,3,3-pentafluoropropyl difluoromethyl ether (CF₃CF₂CH₂OCHF₂), 1,2,3,3,4,4-hexafluorocyclobutane (c-C₄F₆H₂), 1-chloro-1,1,2,2,3,3,4,4-octafluorobutane (CF₂ClCF₂CF₂CF₂H, boiling point: 50°C), 1,2-dichlorohexafluorocyclobutane (-CFCICFCICF₂CF₂-, boiling point: 60°C), and 1,1,1,3,3,3-hexafluoropropan-2-ol (CF₃CH(OH)CF₃, boiling point: 59°C); [[and]]

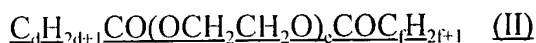
wherein the organic blowing agent further comprises at least one member selected from the group consisting of ethylene glycol compounds and [[amine]] amide compounds [[.]] ; and
wherein the ethylene glycol compound is at least one member selected from the group

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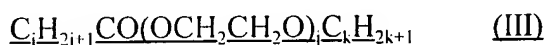
consisting of those of the following Formulae (I), (II) and (III):



wherein a represents 1, 2, 3 or 4; b represents 1, 2 or 3; and c represents 1, 2, 3 or 4;



wherein d represents 0, 1, 2, 3 or 4; e represents 1, 2 or 3; and f represents 0, 1, 2, 3 or 4; and



wherein i represents 0, 1, 2, 3 or 4; j represents 1, 2 or 3; and k represents 1, 2, 3 or 4.

Claim 2 (Canceled).

Claim 3 (Currently Amended): The process according to Claim 1, wherein the organic blowing agent comprises at least one ethylene glycol compound.

Claim 4 (Canceled).

Claim 5 (Previously Presented): The process according to Claim 1, wherein the halogen-containing compound has a boiling point lower than the boiling point of HFC-365mfc (40°C).

Claim 6 (Previously Presented): The process according to Claim 1, wherein the halogen-containing compound is nonflammable and has a boiling point of about 10 to about 60°C and a

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thermal conductivity when it is in the gaseous state of about 8 to about 20 mW/mK at about 1 atmospheric pressure.

Claim 7 (Canceled).

Claim 8 (Previously Presented): The process according to Claim 1, wherein the halogen-containing compound is at least one member selected from the group consisting of saturated or unsaturated hydrofluoroethers (HFEs), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and fluoroiodocarbons (FICs).

Claim 9 (Canceled).

Claim 10 (Previously Presented): The process according to Claim 1, wherein the halogen-containing compound is 1,1,1,2,3,3,3-heptafluoropropane (HFC227ea: $\text{CF}_3\text{CFHCF}_3$).

Claim 11 (Previously Presented): The process according to Claim 1, wherein the proportion of halogen-containing compound is about 1 to about 49 mol per 100 mol of HFC-365mfc and halogen-containing compound in total.

Claim 12 (Previously Presented): The process according to Claim 1, wherein the catalyst is a tertiary amine, an organometallic compound, or a mixture thereof.

Claim 13 (Previously Presented): An organic blowing agent for producing a synthetic resin foam, the organic blowing agent comprising 1,1,1,3,3-pentafluorobutane and at least one halogen-containing compound, the blowing agent being a mixture comprising 1,1,1,3,3-pentafluorobutane and at least one ~~low-boiling~~ halogen-containing compound,

wherein the organic blowing agent and ~~[[the]]~~ a polyol mixture forms a premix which is substantially nonflammable;

wherein the at least one ~~low-boiling~~ halogen-containing compound is nonflammable and has a relatively low thermal conductivity and a boiling point of about -90 to about ~~[[10]]~~ 60°C ~~[[and]]~~,

the thermal conductivity of the halogen-containing compounds in the gaseous state is about 8 to about 30 mW/mK at about 1 atmospheric pressure, and

the halogen-containing compound is at least one member selected from the group consisting of 1,2,2-trifluoroethylene trifluoromethyl ether (CF₂=CFOCF₃), 1,2,2-trifluoroethylene 1,1,2,2,3,3,3-heptafluoropropyl ether (CF₂=CFOCF₂CF₂CF₃), perfluoropropyl epoxide (CF₃CF(O)CF₂), perfluoro-1-butene (CF₂=CFCF₂CF₃), perfluorohexenes (C₆F₁₂), perfluorononenes (C₉F₁₈), perfluorohexane (C₆F₁₄), perfluorocyclobutane (c-C₄F₈), iodotrifluoromethyl (CF₃I), 1,1,1,2,3,3-hexafluoropropane (CF₃CFHCF₂H), 1,1,1,3,3,3-hexafluoropropane (CF₃CH₂CF₃), 1,1,1,2,3,3,3-heptafluoropropane (CF₃CFHCF₃), pentafluoroethane (CF₃CF₂H), tetrafluoroethanes

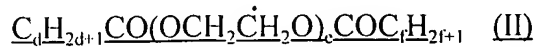
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(CHF₂CHF₂, CF₃CFH₂), trifluoromethane (CF₃H), 1,1,2,2,3,3,4,4-octafluorobutane (CF₂HCF₂CF₂CF₂H), 1,1,1,2,2,3,4,5,5,5-decafluoropentane (CF₃CF₂CFHCFHCF₃), 2-trifluoromethyl-1,1,1,2,3,4,5,5,5-nonafluoropentane (C₆F₁₂H₂), 3,3,4,4,5,5,6,6,6-nonafluoro-1-hexene (F(CF₂)₄CH=CH₂), 2,3,3,4,4,5,5-heptafluoro-1-pentene (CH₂CFCF₂CF₂CF₂H), trifluoroethylene (CF₂CFH), 1,1,2,2-tetrafluoroethyl difluoromethyl ether (CF₂HCF₂OCHF₂), 1,1,2,2-tetrafluoroethyl methyl ether (CF₂HCF₂OCH₃), 2,2,2-trifluoroethyl 1,1,2,2-tetrafluoroethyl ether (CF₃CH₂OCF₂CF₂H), 1,1,2,3,3,3-pentafluoropropyl methyl ether (CF₃CFHCF₂OCH₃), nonafluorobutyl methyl ether (C₄F₉OCH₃), 1-trifluoromethyl-1,2,2,2-tetrafluoroethyl methyl ether ((CF₃)₂CFOCH₃), perfluoropropyl methyl ether (CF₃CF₂CF₂OCH₃), 2,2,3,3,3-pentafluoropropyl difluoromethyl ether (CF₃CF₂CH₂OCHF₂), 1,2,3,3,4,4-hexafluorocyclobutane (c-C₄F₆H₂), 1-chloro-1,1,2,2,3,3,4,4-octafluorobutane (CF₂ClCF₂CF₂CF₂H, boiling point: 50°C), 1,2-dichlorohexafluorocyclobutane (-CFCICFCICF₂CF₂-, boiling point: 60°C), and 1,1,1,3,3,3-hexafluoropropan-2-ol (CF₃CH(OH)CF₃, boiling point: 59°C); [[and]]

wherein the organic blowing agent further comprises at least one member selected from the group consisting of ethylene glycol compounds and [[amine]] amide compounds [[.]] ; and wherein the ethylene glycol compound is at least one member selected from the group consisting of those of the following Formulae (I), (II) and (III):

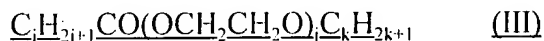


wherein a represents 1, 2, 3 or 4; b represents 1, 2 or 3; and c represents 1, 2, 3 or 4;



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wherein d represents 0, 1, 2, 3 or 4; e represents 1, 2 or 3; and f represents 0, 1, 2, 3 or 4; and



wherein i represents 0, 1, 2, 3 or 4; j represents 1, 2 or 3; and k represents 1, 2, 3 or

4.

Claim 14 (Canceled).

Claim 15 (Currently Amended): The blowing agent according to Claim 13 comprising at least one ethylene glycol compound.

Claim 16 (Previously Presented): The blowing agent according to Claim 13, wherein the halogen-containing compound is 1,1,1,2,3,3,3-heptafluoropropane (HFC227ea: $\text{CF}_3\text{CFHCF}_3$).

Claim 17 (Previously Presented): A premix for producing a synthetic resin foam, the premix comprising 1,1,1,3,3-pentafluorobutane, at least one halogen-containing compound and at least one polyol,

the blowing agent being a mixture comprising 1,1,1,3,3-pentafluorobutane and at least one ~~low-boiling~~ halogen-containing compound,

wherein the premix is substantially nonflammable;

wherein the at least one ~~low-boiling~~ halogen-containing compound is nonflammable

and has a relatively low thermal conductivity and a boiling point of about -90 to about [[10]] 60°C
[[and]],

the thermal conductivity of the halogen-containing compounds in the gaseous state
is about 8 to about 30 mW/mK at about 1 atmospheric pressure, and

the halogen-containing compound is at least one member selected from the group
consisting of 1,2,2-trifluoroethylene trifluoromethyl ether ($\text{CF}_2=\text{CFOCF}_3$), 1,2,2-trifluoroethylene
1,1,2,2,3,3,3-heptafluoropropyl ether ($\text{CF}_2=\text{CFOCF}_2\text{CF}_2\text{CF}_3$), perfluoropropyl epoxide
($\text{CF}_3\text{CF}(\text{O})\text{CF}_2$), perfluoro-1-butene ($\text{CF}_2=\text{CFCF}_2\text{CF}_3$), perfluorohexenes (C_6F_{12}), perfluorononenes
(C_9F_{18}), perfluorohexane (C_6F_{14}), perfluorocyclobutane ($c\text{-C}_4\text{F}_8$), iodotrifluoromethyl (CF_3I),
1,1,1,2,3,3-hexafluoropropane ($\text{CF}_3\text{CFHCF}_2\text{H}$), 1,1,1,3,3,3-hexafluoropropane ($\text{CF}_3\text{CH}_2\text{CF}_3$),
1,1,1,2,3,3,3-heptafluoropropane ($\text{CF}_3\text{CFHCF}_3$), pentafluoroethane ($\text{CF}_3\text{CF}_2\text{H}$), tetrafluoroethanes
(CHF_2CHF_2 , CF_3CFH_2), trifluoromethane (CF_3H), 1,1,2,2,3,3,4,4-octafluorobutane
($\text{CF}_2\text{HCF}_2\text{CF}_2\text{CF}_2\text{H}$), 1,1,1,2,2,3,4,5,5,5-decafluoropentane ($\text{CF}_3\text{CF}_2\text{CFHCFHCF}_3$), 2-
trifluoromethyl-1,1,1,2,3,4,5,5,5-nonafluoropentane ($\text{C}_6\text{F}_{17}\text{H}_2$), 3,3,4,4,5,5,6,6,6-nonafluoro-1-hexene
($\text{F}(\text{CF}_2)_4\text{CH}=\text{CH}_2$), 2,3,3,4,4,5,5-heptafluoro-1-pentene ($\text{CH}_2\text{CFCF}_2\text{CF}_2\text{CF}_2\text{H}$), trifluoroethylene
(CF_2CFH), 1,1,2,2-tetrafluoroethyl difluoromethyl ether ($\text{CF}_2\text{HCF}_2\text{OCHF}_2$), 1,1,2,2-tetrafluoroethyl
methyl ether ($\text{CF}_2\text{HCF}_2\text{OCH}_3$), 2,2,2-trifluoroethyl 1,1,2,2-tetrafluoroethyl ether
($\text{CF}_3\text{CH}_2\text{OCF}_2\text{CF}_2\text{H}$), 1,1,2,3,3,3-pentafluoropropyl methyl ether ($\text{CF}_3\text{CFHCF}_2\text{OCH}_3$),
nonafluorobutyl methyl ether ($\text{C}_4\text{F}_9\text{OCH}_3$), 1-trifluoromethyl-1,2,2,2-tetrafluoroethyl methyl ether
($(\text{CF}_3)_2\text{CFOCH}_3$), perfluoropropyl methyl ether ($\text{CF}_3\text{CF}_2\text{CF}_2\text{OCH}_3$), 2,2,3,3,3-pentafluoropropyl

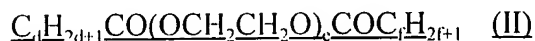
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difluoromethyl ether (CF₃CF₂CH₂OCHF₂), 1,2,3,3,4,4-hexafluorocyclobutane (c-C₄F₆H₂), 1-chloro-1,1,2,2,3,3,4,4-octafluorobutane (CF₂ClCF₂CF₂CF₂H, boiling point: 50°C), 1,2-dichlorohexafluorocyclobutane (-CFCICFCICF₂CF₂-, boiling point: 60°C), and 1,1,1,3,3,3-hexafluoropropan-2-ol (CF₃CH(OH)CF₃, boiling point: 59°C); [[and]]

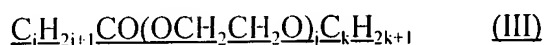
wherein the organic blowing agent further comprises at least one member selected from the group consisting of ethylene glycol compounds and [[amine]] amide compounds[[.]]; and
wherein the ethylene glycol compound is at least one member selected from the group consisting of those of the following Formulae (I), (II) and (III):



wherein a represents 1, 2, 3 or 4; b represents 1, 2 or 3; and c represents 1, 2, 3 or 4;



wherein d represents 0, 1, 2, 3 or 4; e represents 1, 2 or 3; and f represents 0, 1, 2, 3 or 4; and



wherein i represents 0, 1, 2, 3 or 4; j represents 1, 2 or 3; and k represents 1, 2, 3 or 4.

Claim 18 (Canceled).

Claim 19 (Currently Amended): The premix according to Claim 17 comprising at least one ethylene glycol compound.

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Claim 20 (Previously Presented): The premix according to Claim 17, wherein the halogen-containing compound is 1,1,1,2,3,3,3-heptafluoropropane (HFC227ea: $\text{CF}_3\text{CFHCF}_3$).

Claim 21 (Previously Presented): The premix according to Claim 17 that is nonflammable.